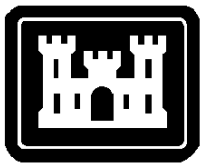

US Army Corps
of Engineers
Hydrologic Engineering Center

Hydrologic Modeling System HEC-HMS

Differences Between HEC-HMS and HEC-1

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Introduction

Development of the Hydrologic Modeling System (HEC-HMS) was initiated as part of the Next Generation Software Project. It was designed to succeed the aging HEC-1 program for simulating the rainfall-runoff process. However, it was not designed to simply add a graphical user interface to the old program. Instead it was designed to use advances in engineering and computer science wherever possible to improve the quality of simulation results. The modernization process has therefore resulted in some changes in how computations are performed. While these modernizations result in computation differences between the two programs, the HEC-HMS results are preferred because of the modern techniques that have been implemented. Changes in parameter specifications or computations are detailed in the following sections.

Recession Baseflow

The recession baseflow method includes a recession constant for specifying the rate at which recession flow decreases with time. In HEC-HMS the parameter is defined as the ratio of the current recession flow to the recession flow one day earlier. In HEC-1 the parameter, called RTIOR, is defined as the ratio of the current recession flow to the flow one hour later. The following equation can be used to convert an HEC-1 recession constant for use in HEC-HMS:

$$Recession\ Constant = \frac{1}{(RTIOR)^{24}}$$

Clark Unit Hydrograph

The Clark method produces a unit hydrograph that theoretically has an infinite number of ordinates, because each ordinate on the tail of the unit hydrograph is computed by multiplying the preceding ordinate by a constant fraction. In both HEC-HMS and HEC-1, the tail of the unit hydrograph is truncated when the volume represented by the unit hydrograph exceeds 0.995. In HEC-HMS the ordinates are then adjusted to produce a volume of 1.000. No adjustment is made in HEC-1.

Channel Physical Properties

Hydraulic properties of channels with prismatic cross sections are computed differently in HEC-HMS and HEC-1. In HEC-HMS properties are computed from the physical properties of the channel, whereas in HEC-1 the properties are computed with formulas based on the kinematic wave assumption. In HEC-HMS the cross-sectional flow area is computed as:

$$A = y(w + z\,y)$$

and the ratio of wave speed, c, to flow velocity, v, is:

$$\frac{c}{v} = \frac{(10\,w\,z\,y) + \left(16\,z\,y^2\sqrt{z^2+1}\right) + \left(5\,w^2\right) + \left(6\,w\,y\sqrt{z^2+1}\right)}{2\left(w + 2\,z\,y\right)\left(w + 2\,y\sqrt{z^2+1}\right)}$$

where *w* is the bottom width, *z* is the side slope, and *y* is the flow depth. Velocity is computed using Manning's formula. In HEC-1 the cross-sectional flow area is computed as:

$$A = \left(\frac{Q}{\alpha} \right)^{\frac{1}{m}}$$

and the wave speed, c, is computed as:

$$c = \alpha m A^{m-1}$$

where α and *m* are kinematic parameters based on the channel shape.

8-Point Cross Sections

Hydraulic properties of channels with 8-point cross sections are computed differently in HEC-HMS and HEC-1. In HEC-HMS the flow depth for a given discharge is determined from the cross-sectional characteristics and then area, top width, and wave speed are computed for that depth using the cross-sectional data. In HEC-1 the discharge, area, top width, and wave speed are computed for 20 depths and stored in a table. During the routing process, area, top width, and wave speed are interpolated from the table for each discharge value.